

## APPENDIX F: RESULTS OF THE RISK ASSESSMENT – DETAILED SUMMARY

Effects of all herbicides have been assessed in the Final Environmental Impact Statement for Vegetation Management in the Appalachian Mountains (VMEIS). For all herbicides considered a risk analysis was completed using methodology developed for the Forest Service by Syracuse Environmental Research Associates (SERA). SERA risk assessment worksheets incorporate the best available science (ver. 5.00.64, February 2011). The details of the risk assessment are available in the project record. In the risk assessments, there are two terms not used in the VMEIS. These are Reference Dose (RfD) and Hazard Quotient (HQ).

- **RdD** – Derived by USEPA, this is the maximum dose in mg of pesticide active ingredient per kg of body weight per day that is not expected to cause injury over a lifetime of exposure. In other words, it is, in EPA’s opinion, a “safe” lifetime daily dose. This is a conservative estimate, and is designed to be protective.

- **HQ** – This is the ratio of the estimated exposure dose to the RfD. A HQ of 1 reflects an exposure to amounts of a.i. less than RfD, while HQ’s greater than 1 reflect exposures to amounts of a.i. greater than the RfD. HQs of 1.0 or less reflect exposure levels that are not of concern. HQs greater than 1.0 reflect exposures to possible effects to be examined more closely to see if the projected exposures need to be further mitigated or need to be avoided. For the effects on wildlife, one must remember that these effects are constructed for individuals and not populations.

For Alternatives 2 and 3, the spill plan in Appendix 2 would be adopted. These alternatives also assume that all design features in Appendix 3 of this document would be followed, as would the mitigation measures in the VMEIS. Published analyses of environmental effects in the VMEIS are not duplicated in this document. However, information published subsequent to the VMEIS encountered in the open literature that is relevant to this analysis and demonstrates a potential for significant effect on the conclusions drawn in the VMEIS has been included in the current analysis.

The following table shows the basis for estimated herbicide application rates that are used in the risk analysis:

Herbicide	Application Method(s)	Lbs ai/gal	% (fraction) in solution	Gallons of solution/acre	Lbs ai/acre
Triclopyr (amine)	Cut-surface	3.0	50%	1.0	1.5
Triclopyr (amine)	Foliar	3.0	4%	15	1.8

For each pesticide, hazard quotients are developed that summarize risk characteristics for workers, the general public, terrestrial animals and aquatic species. For this analysis, hazard quotients derived from spill scenarios into ponds have been set to zero because this project has design features (Appendix 3) which make such spills highly improbable and further analysis unnecessary. In addition, in the unlikely event of a spill, expedited clean-up would be required and pesticide applications would be immediately stopped until clean-up efforts were complete. The specific spill scenario referenced is: acute/accidental exposure, contaminated water consumed by a child (sheet E04).

Hazard quotients for the general public involving direct spray exposures to the entire body or lower legs are also considered highly unlikely so as to be irrelevant. These values have also been set to zero for this risk analysis.

The most important hazard quotient is the general exposure HQ for workers. Field crews who apply pesticides are most likely to have direct exposure to pesticides. According to Forest Service Southern Region Pesticide Specialist, the central HQ best reflects a realistic upper exposure and risk for workers using required personal protective equipment (PPE) and employing proper washing and hygiene habits.

The pesticide considered for use under Alternatives 2 and 3 of this EA is triclopyr amine. Hazard quotients were calculated for the estimated application rates of these pesticides as described in the table above. Only HQs greater than 1.0 are discussed below.

#### **Triclopyr (amine) - cut surface treatments (cut stump and injection) @ 1.5 lbs/ac**

*Workers:* Typical (central) HQs for cut surface applications of Triclopyr (amine) for workers (sheet E02) are all less than 1.0 under accidental and general exposures; the upper bound HQ value for general chronic exposure under backpack applications was over 1.0. However, the upper bound exposure is unlikely because this scenario assumes 90 consecutive days of exposure, and according to the Forest Service Southern Region Pesticide Specialist, the central HQ best reflects the realistic upper exposure and risk for workers using appropriate PPE and employing proper washing and hygiene habits. Forest Service employees are trained and required to follow safe pesticide applicator practices, including PPE and hygiene habits.

*General Public:* Typical (central) HQs for the general public (sheet E04) are all under 1.0 except for one scenario – non-accidental acute exposure of an adult female consuming treated vegetation. Typical HQ under this scenario is 5.0 and the lower bound 0.3. This scenario is highly unlikely because pesticide application areas are signed to preclude public exposure and with cut surface applications, the amount of non-target vegetation subject to over-spray is very small. Upper bound HQs for acute and chronic exposure through consumption of contaminated fruit and vegetation by a female were over 1.0 under the application rate analyzed. These scenarios are also unlikely and not of concern for the same reasons described above, and because typical (central) values represent the most likely exposure and risk and chronic exposures assume contaminated fruit and vegetation are consumed for 90 consecutive days.

*Terrestrial Animals:* HQs for non-accidental acute and chronic exposures (sheet G02a) for large mammals and small birds consuming contaminated fruit and/or vegetation have typical values over 1.0 (range = 3.0 to 7.0). However these scenarios are unlikely and the risks of such contamination are reduced due to the following:

- With cut-stump applications, trees are severed from their stumps and the herbicide is applied to the cut-stump surface and therefore there is no risk of contaminated fruit or vegetation.
- With stem injections treatments, vegetation to be treated is typically above forage/browse levels for mammals and therefore there is little risk of consumption of contaminated vegetation. Also, the rate at which contaminated fruit/vegetation becomes unappetizing and unavailable reduces the period of exposure making chronic exposure highly unlikely.
- Cut surface treatments (cut stump and stem injections) are very targeted and precise and apply very small amounts of diluted herbicide. The amount of non-target vegetation subject to spray deposition consequently is very small and unlikely to affect foraging/browsing mammals or birds.
- These scenarios assume a diet composed of 100 percent contaminated fruit or vegetation from the site. The diets of large mammals and birds are highly variable and include other food sources. For chronic exposures, scenarios assume that contaminated fruit or vegetation will be consumed for 90 consecutive days. These assumptions make scenarios highly unlikely especially in context of the other reasons stated above.
- Also, these scenarios are based on individuals, and although an individual may be affected, there would not be significant effects to a population.

Upper bound HQs were above 1.0 for non-accidental acute and chronic exposures for small, larger, and large mammals and for small and large birds consuming contaminated fruit and vegetation in most scenarios. Upper bound HQs for non-accidental acute exposure of small birds consuming contaminated insects was also above 1.0. Typical HQs were below 1.0 for these scenarios, except for large mammals and small birds (as noted above). Such scenarios are unlikely and are not of concern for the reasons described above and because typical (not upper bound) values represent the most likely exposure and risk.

*Aquatic Species:* Fish and aquatic invertebrates under accidental (spill) acute exposures have upper bound HQ values that exceed 1.0, but typical HQ values are under 1.0. Typical HQs for aquatic sensitive macrophytes (plants) under accidental and non-accidental acute and chronic exposure scenarios have calculated values over 1.0 (sheet G03). Algae also have calculated typical and upper bound HQ values over 1.0 under accidental acute exposures. However these scenarios are unlikely and the risks of such contamination are reduced due to the following:

- Triclopyr is generally non-mobile in soils except under gross spills and misapplications and cut surface treatments are very precise allowing little chance of misapplication or mass spills.
- Herbicides would not be applied within 100 feet of perennial or intermittent streams, lakes, ponds, or other water-bodies.
- Most herbicide applications in the analysis area would be confined to ridgetops and upper and mid-slopes, well away from riparian areas.
- Other design criteria would be employed that protect aquatic resources including weather parameters, mixing, loading, cleaning and transport standards and guidelines as described

in Appendix 3.

*Terrestrial Plants:* Typical HQs for terrestrial vegetation from runoff of triclopyr amine (sheet G04) has a calculated value over 1.0 (1.4). The contamination of non-target vegetation due to runoff of herbicide under this application is unlikely for the following reasons:

- Herbicides would not be applied when there is a high probability for precipitation.
- Cut surface treatments are very targeted and applied in small amounts to cut surfaces (cut stumps) or incisions in stems (injections – hack and squirt) of selected individuals. Very little herbicide would reach the soil, limiting the amount of herbicide solution that could potentially leach or runoff and affect non-target terrestrial vegetation.

*Predatory or Herbivorous Insects:* Upper HQ values for acute exposures of insects consuming short grass vegetation (sheet G08b) are over 1.0 (1.3); typical HQ values are under 1.0. Contamination of short grasses and acute exposure due to consumption of short grasses by herbivorous insects is unlikely because:

- Typical (not upper) values represent the most likely exposure and risk.; and
- Cut surface treatments (cut stump and stem injections) are very targeted and precise and apply very small amounts of diluted herbicide. The amount of non-target vegetation subject to spray deposition consequently is very small and unlikely to affect herbivorous insects.
- The period in which non-targeted vegetation remains edible/available following treatment would be very short and would limit exposure time.

#### **Triclopyr (amine) - foliar treatments @ 1.8 lbs/ac**

*Workers:* Central HQs for foliar applications of Triclopyr (amine) for workers (sheet E02) are all less than 1.0 under accidental and general exposures; the upper bound HQ value for general chronic exposure under backpack applications was over 1.0. However, the upper bound exposure is unlikely because this scenario assumes 90 consecutive days of exposure, and according to the Forest Service Southern Region Pesticide Specialist, the central HQ best reflects the realistic upper exposure and risk for workers using appropriate PPE and employing proper washing and hygiene habits. Forest Service employees are trained and required to follow safe pesticide applicator practices, including PPE and hygiene habits.

*General Public:* Typical (central) HQs for the general public (sheet E04) are all under 1.0 except for one scenario – non-accidental acute exposure of an adult female consuming treated vegetation. Typical HQ under this scenario is 6.0 and the lower bound 0.4. This scenario is unlikely because foliar applications under this proposal would be targeted to treat stump sprouting vegetation which is unlikely to be consumed by human females and pesticide application areas are signed to preclude public exposure. Targeted applications to stump sprouting vegetation would also limit the amount of non-target vegetation accidentally contaminated.

Upper bound HQs for acute and chronic exposure through consumption of contaminated fruit and vegetation by a female were over 1.0 under the application rate analyzed. These scenarios are also unlikely and are not of concern for the same reasons described above, and because

typical (central) values represent the most likely exposure and risk, and chronic exposures assume contaminated fruit and vegetation are consumed for 90 consecutive days.

*Terrestrial Animals:* Typical HQ values for non-accidental acute exposure from consumption of contaminated vegetation by large mammals and small birds are over 1.0 (4.0 and 5.0, respectively). Typical HQ values for chronic exposures resulting from consumption of contaminated fruit by large mammals and small birds, and from consuming contaminated vegetation by small, larger, and large mammals and small birds are over 1.0 as well (sheet G02a). However these scenarios are unlikely and the risks of such contamination are reduced due to the following:

- Foliar treatments would be applied with backpack sprayers and applied to target stump sprouts; contamination to non-target vegetation most likely to be consumed would be minimal.
- The period in which treated vegetation (stumps sprouts and adjacent non-target vegetation) remains edible/available following treatment would be very short and would limit exposure time.
- These scenarios assume a diet composed of 100 percent contaminated fruit or vegetation from the site. The diets of large mammals and birds are highly variable and include other food sources.
- Stump sprouting vegetation is targeted for treatment under foliar applications. This vegetation would not produce fruit to be consumed by wildlife species.
- For chronic exposures, scenarios assume that contaminated fruit or vegetation will be consumed for 90 consecutive days. These assumptions make scenarios highly unlikely especially in context of the other reasons stated above.
- Also, these scenarios are based on individuals, and although an individual may be affected, there would not be significant effects to a population.

Upper bound HQs were above 1.0 for non-accidental acute and chronic exposures for small, larger, and large mammals and for small and large birds consuming contaminated fruit and vegetation in most scenarios. Upper bound HQs for non-accidental acute exposure of small birds consuming contaminated insects was also above 1.0. Typical HQs were below 1.0 for these scenarios, except for large mammals and small birds (as noted above). These scenarios are unlikely and are not of concern for the reasons described above and because typical (not upper bound) values represent the most likely exposure and risk.

*Aquatic Species:* Fish and aquatic invertebrates under accidental (spill) acute exposures have upper bound HQ values that exceed 1.0, but typical HQ values are under 1.0. Typical HQs for aquatic sensitive macrophytes (plants) under accidental and non-accidental acute and chronic exposure scenarios have calculated values over 1.0 (sheet G03). Algae also have calculated typical and upper bound HQ values over 1.0 under accidental acute exposures and upper bound HQ values over 1.0 for non-accidental acute exposures. These scenarios are unlikely and are not of concern because due to the following:

- Triclopyr is generally non-mobile in soils except under gross spills and misapplications. Backpack applied foliar applications would be targeted for stump sprout vegetation only, producing little chance of misapplication or mass spills.
- Herbicides would not be applied within 100 feet of perennial or intermittent streams, lakes, ponds, or other water-bodies.

- Most herbicide applications in the analysis area would be confined to ridgetops and upper and mid-slopes, well away from riparian areas.
- Other design criteria would be employed that protect aquatic resources including weather parameters, mixing, loading, cleaning and transport standards and guidelines as described in Appendix 3.

*Terrestrial Plants:* Typical HQ for terrestrial vegetation from runoff of triclopyr amine (sheet G04) has a calculated value over 1.0 (1.7). The contamination of non-target vegetation due to runoff of herbicide under this application is unlikely for the following reasons:

- Herbicides would not be applied when there is a high probability for precipitation.
- Foliar applications would be performed with backpack sprayers in a very selective method to stump sprout vegetation. Little overspray would occur, limiting the amount of herbicide reaching the soil and available for runoff and contamination of non-target vegetation.

*Predatory and Herbivorous Insects:* Upper HQ values for acute exposures of insects consuming short grass vegetation (sheet G08b) are over 1.0 (1.5); typical HQ values are under 1.0. Contamination of short grasses and resulting acute exposure due to consumption of contaminated short grasses by herbivorous insects is unlikely because:

- Typical (not upper) values represent the most likely exposure and risk.; and
- Foliar applications are targeted to stump sprouting vegetation; contamination to nontarget vegetation most likely to be consumed by insects would be minimal.
- The period in which treated non-targeted vegetation remains edible/available following treatment would be very short and would limit exposure time.